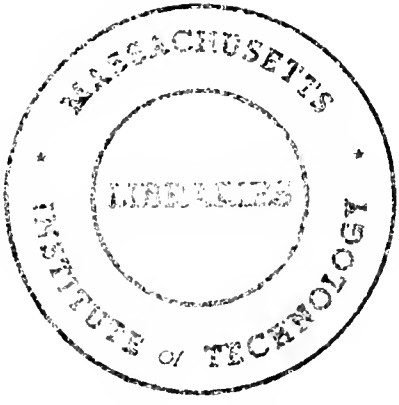
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Horizontal Diffusion of Innovations: An Alternative Paradigm to the Classical Diffusion Model

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Abstract

In this paper we present a paradigm of diffusion which contrasts along several key dimensions with the classical diffusion model as exemplified by the U.S. Department of Agriculture Extension Service. The alternative model, "horizontal" or "decentralized" diffusion, has these characteristics: (1) relatively more user innovation and (2) innovation dissemination among and by peers. Several extant, relatively horizontal diffusion systems are briefly described in order to highlight the differences between centralized and decentralized diffusion strategies and to raise issues for empirical investigation.

The Alternatives

The Classical Diffusion Model

For decades, one diffusion model has dominated the thinking of planners in both the public and private sector. In this model, an innovation originates from, and is legitimized by, some expert source. This source then diffuses the innovation as a relatively uniform package to potential adopters who accept or reject the innovation, usually in its original form; adopters are not expected to modify the innovation. This model owes much of its popularity to the success of the United States Agricultural Extension Service (described below), and to commercial

marketing strategies, especially as the latter have migrated into the public sector.[1]

The Horizontal Diffusion Model

In recent years, challenges to this classical model have come from several quarters. Schon (1971) was among the first scholars to note that theories of diffusion had "characteristically lagged behind the reality of emerging systems." He particularly criticized the classical diffusion theory, which he named the "center-periphery model" because of the tendency for innovations to originate in, and radiate out from, a centralized legitimizing source. While recognizing that this model does apply in many cases, Schon noted that it fails to capture the complexity of system-wide social change in which innovations originate from numerous sources and evolve as they diffuse.

These two characteristics of some innovation processes -- multiple sources of invention and the changing nature of the innovations as they are disseminated -- have also been noted by other researchers. Von Hippel (1976) found in several industries that users invent the product or process they need and take the innovation back to manufacturers or suppliers for production. Rogers (1977) recognized that the "re-invention" of innovations may occur as adopters adapt an innovation to their particular needs and situations. Thus, whether adopters/users take part in the innovation process at the level of origination[2] or at the level of

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[1] "Social marketing," the promotion of goods and services in the public sector for the benefit of society at large (e.g., family planning, nuitrition, use of seat belts, energy conservation) exemplifies another form of the classical diffusion model (see Kotler and Zaltman, 1971).

[2] We follow here the classification scheme suggested by Pelz and Munson (1980) in which they divide the innovation process into levels: (1) origination (invention), (2) adaptation (re-invention), and (3) borrowing (adoption without change).

adaptation, they are much more active participants than the classical diffusion model would suggest. Diffusion can be, and often is, a very interactive process.

The present vogue of the term "networks" in the United States reflects another trend -- the recognition of the human resources embodied in clusters of individuals who support each other through self-generated organizations. These relatively unstructured systems tend to grow up around a single political, social or economic issue. Anthropologist Luther Gerlach and his colleagues, who studied active social movements such as the black power and anti-war movements, find such movements characterized by shifting leadership centers among loosely-connected networks. Gerlach (1980) characterizes these movements as segmentary (many groups), polycentric (many leaders), and integrated in networks (characteristics he captures in the acronym SPIN). Such networks foster the dissemination of social and political innovations.

These new research trends all substantiate an alternative model of diffusion which exists both as an unintentional effect of mass media concentration on local sites of innovation (the case of Davis, California is described below) and as a deliberate diffusion system built around a "horizontal" exchange of information about innovations among peers (as in the case of the computerized Legitech system described below). This alternative diffusion strategy, which we term either "horizontal" or "decentralized" (the terms are interchangeable for our purposes), we describe as diffusion characterized by the dissemination of innovations from their originators through peer networks. There are four crucial elements in any diffusion strategy whose characteristics distinguish different types:

1. Who innovates.
2. Who legitimizes the innovation.
3. Who diffuses the innovation.
4. How the innovation is diffused.

While there are in reality no "pure" forms of an entire diffusion system built upon either an extreme centralized or a completely decentralized strategy, it is convenient to compare two hypothetical extremes, characterized by almost opposite emphases on the sources of innovation, their legitimization, and the diffusion of innovations. It is also convenient to illustrate the differences between these systems by examining, first, real life examples which approach the theoretical extremes, and second, other diffusion systems which are hybrids of centralized/decentralized systems, embodying characteristics of both extremes. In short. the degree of centralization or decentralization is a relative, not an absolute, characteristic in the real world. We describe existing systems as sample points along a hypothesized continuum between the two extremes (Figure 1).

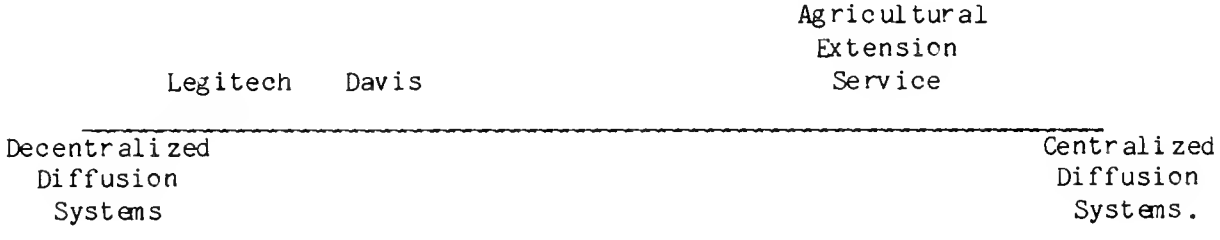

Figure 1

A Schematic of the Centralized/Decentralized Continuum of Diffusion Systems

In the pages which follow, we compare a number of extant diffusion systems according to the four crucial elements named above, indicating briefly where the characteristics differ among systems. We follow this discussion by a presentation of issues highlighted by the comparisons, and,

finally, suggest directions for future research on the topic (Figure 2).

	Extremely Centralized Diffusion System	Extremely Decentralized Diffusion System
Who Innovates	R&D laboratories	Users
Who Legitimizes	Experts	The adoption process
Who Diffuses	Centralized authority	Users
How the innovation is diffused	Through a hierarchical, structured system using officially designated, professional change agents	Face-to-face, usually through personal contacts; the users serve as unofficial change agents

Figure 2

Major Points of Comparison Among Diffusion Systems

Who innovates.

The U.S. Agricultural Extension Services

The 50 state agricultural extension services in the U.S., operating cooperatively with the U.S. Department of Agriculture's (USDA) Federal Extension Service, represent the largest public investment in a diffusion system in the U.S. and in the world.

The usual flow of agricultural innovations has been from the USDA and state agricultural experiment stations to state extension specialists stationed in state agricultural universities, through them to county extension agents, and finally to individual farmers. The innovation agencies usually have been R&D specialists, Ph.D's whose scientific work provided the new hybrid seeds, the methods for crop rotation, and the specialized fertilizers -- all of the innovations which have given American farmers a deservedly high reputation for production efficiency. Once the innovation reaches the level of the individual farmer in this predominately center-periphery model of diffusion, lateral transfer of the information

does occur, of course, through peer networks. However, the point is that almost all of the innovations originate from people who never intend to use the products they design and whose primary role is to function as a prolific source of innovations.[3] Thus, the agricultural extension model serves as an example of a relatively centralized diffusion system.

Legitech on EIES

In contrast, innovations in a relatively horizontal diffusion system often originate from multiple sources, from individuals who either have used or intend to use the innovation themselves and who choose to place themselves in the role of expert by providing information to their peers. Technological innovations in such decentralized systems can derive from "craft knowledge" and from exemplary practice by practitioners as well as from formal research and development activities. While an individual or organization whose formal role outside the network consists of providing innovations may be insinuated into a horizontal diffusion system, the system is not dependent upon such officially designated "expert" sources.

No pure examples of an intentionally horizontal diffusion network have been identified yet by the authors, but the potential for such a system exists through a recently developed form of computer conferencing called by its originators "inquiry networking" (Stevens, 1980).

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[3]Recently an interesting incident has proven that even the agricultural extension service is not immune to user innovation. Bob Bergland, U.S. Secretary of Agriculture under the Carter administration, initiated research into methods of organic farming when he discovered that a respected neighbor of his in Minnesota had switched to farming his 1,500 acres organically. The research revealed that far from being the "crackpots" that agricultural scientists had tended to label them, organic farmers were producing crops comparable to those raised with chemical fertilizers -- often at lower costs. This discovery led to a reversal of the U.S.D.A.'s former position discouraging organic farming. The center, in other words, followed the lead of the periphery in this case. However, once the idea of organic farming was accepted by the U.S.D.A., it was diffused in the usual fashion to farmers from the center.

Several experimental inquiry networks have been set up on the Electronic Information Exchange System (EIES), which supports numerous other computer conferences and electronic messaging systems as well. The inquiry networks which come closest to realizing the potential for horizontal diffusion are the "Legitech" system for exchange of scientific and technical information among the legislative staff of the various states, and "Localtech" for the exchange of similar information among municipalities. In Legitech, a state legislator wishing to solicit suggestions for solving a problem (e.g., the clean up of hazardous waste dumping sites) can send out a general inquiry on this topic over the computer network to find out how other states have responded to the problem. Any other legislators, as well as a number of resource groups on the teleconferencing system, such as the regional innovation groups set up by the National Science Foundation to aid local governments in solving problems, can respond to the inquiry.

The response may take the form of either a specific technical solution, a reference to print or human resources which can supply an answer, or both. Sometimes the response is in the form of reference to a bill originated by a legislator on the system. Members of the Legitech system who did not ask the question but who are interested in the response may also access all answers. All system users are therefore potential sources of innovative ideas. In actual practice, the legislative staff provide as many of the responses as, or more than, those agencies whose designated role (quite apart from the computer network) is to serve the state legislatures as sources of innovation. Thus, many of the innovations diffused through Legitech originate from users -- practitioners in the field, often who have tried the solutions they suggest and whose bills or

mandates can serve as models for other legislatures on the system. Similarly, municipal authorities facing some local problem which they know their peers may have faced before them (e.g. the lease/purchase decision about municipal fleets; riot control) can seek innovative solutions from other municipalities through Localtech.

Neither of these examples attains the hypothetical ideal horizontal diffusion system, in which mayors might exchange innovative ideas directly, on-line. Rarely do the state legislators or the municipal officers themselves operate the computer; usually a staff member does. Moreover, not all of the innovations diffused originate from people on the network. As noted before, many responses to the inquiry come in the form of references to other innovation sources or to experts in the area of inquiry. However, these inquiry networking systems exemplify many characteristics which differ from the traditional center-periphery model of diffusion, and which are therefore worth considering in some detail.

Obviously, different types of credibility accrue to the innovation sources in centralized than in horizontal networks. In the more centralized system of the agricultural extension service, the diffusion system is government-backed. Given the fact that technological advances may discredit products and processes previously pushed by government experts (e.g., chemicals such as DDT), government sources are not regarded as infallible. Nevertheless, receivers in such a diffusion system know the official credentials of the person or organization offering advice. The sources are technically credible.

However, the weight of the government organization behind an innovation can be a detriment as well as an advantage in diffusing the innovation. In some cases, the centralized innovation source may be

perceived as placing more importance on the government's agenda than on the adopter's. In short, the centralized source often has "an axe to grind".[4] Therefore such a source may possess "competence" but not "safety" credibility[5].

An innovation source in a decentralized, horizontal system can possess the opposite strength and weakness. A peer is often a highly trusted source of information because, from the point of view of the user, he or she is someone "like me" -- someone who has actually experienced the innovation s/he suggests and who does not stand to benefit personally from the adoption or rejection of the innovation.[6] A peer source therefore often has "safety credibility."

However, a peer may lack technical expertise, both in judging the innovation and in accurately transmitting the information to the adopters. The technical credibility of the innovator in the horizontal diffusion system can derive from hands-on experience with the innovation itself, rather than from official credentials. The longer term the experience, the more credibility, since any deficiencies in the practice or product being suggested would presumably have surfaced over time. However, obviously

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[4]For instance government agencies advocating birth control in developing nations are sometimes viewed with some suspicion by potential adopters who believe small families are more to the government's advantage than to their own.

[5]Berlo and others (1970) found these two dimensions of source credibility through a factor analysis of semantic differential data. Competence credibility is based on the perceived technical expertise of the information source; safety credibility reflects the extent to which the source is perceived as being a peer, with needs comparable to those of the information recipient's.

[6]There are numerous studies which demonstrate the powerful influence of peers on innovation decisions (Leonard-Barton, 1980; Rogers with Shoemaker, 1971). A peer could have reason to push an innovation, or course as for instance to obtain a critical mass of adopters for some desired community or group innovation.

this test of time can only apply to innovations which are new to the adopter but which were in fact invented at some time previously. Presumably most innovations by definition do not fall into that category. Technical credibility therefore can be a special problem in horizontal diffusion systems.[7]

Who Legitimates.

Another way of stating this issue is, "What control is there in a diffusion system over the quality of innovations that diffuse?" This question relates closely to source credibility. The U.S.D.A. and state agricultural researchers, state extension specialists, and the county extension workers legitimate the innovations they diffuse. This legitimating process is presumably the culmination of scientific evaluations that have been conducted of the innovation.

In the "pure" horizontal diffusion system, no one person or category of persons officially legitimates the innovation; the innovation is legitimized only by its success in diffusing--by cumulative experience. In other words, the system as a whole legitimizes the innovation through the adoption process. An innovation is legitimized only in so far as it is actively accepted by members in the system (and its legitimacy is not challenged by members of the system). Through accumulated experience, users of the system also assign varying degrees of source credibility to their peers. In Legitech, for instance, certain innovation information sources have earned the respect of others on the system for careful and

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[7]There are systems composed of networks of highly educated and technically competent practitioners -- cardio-vascular surgeons, for example -- who exchange innovative information. In one sense, technical credibility is not a problem in such systems; all participants are experts. However, the surgeons do not all possess equal credibility as innovation sources.

competent responses to inquiries. Among professional associations, some of which function as horizontal diffusion systems for experts, (e.g., surgeon's associations) members become known over time as reliable or incompetent innovation sources. Their reputations, in other words, establish them as innovation legitimizers, but this role is unofficial. Moreover, there may be no consensus among members of the network regarding who are the legitimizers.

Who Diffuses the Innovation and How.

In the centralized system, the county extension worker's explicit raison d'etre is to function as a change agent, transferring new technology to farmers. There is no expectation that the farmers will adapt, modify or "re-invent" the innovation. The change agent, who measures his/her professional success at least partially on the basis of how well the innovations s/he promotes diffuse through the potential adopter population, targets those farmers whom s/he knows to be opinion leaders and those farmers to whom the innovation offers the greatest relative advantage over whatever their current practices are. In other words, part of the change agent's function is to select the starting points for the diffusion process.

One of the criticisms of the centralized diffusion strategy is that it has sometimes functioned to favor those adopters who are already advantaged relative to others in the system. For example, wealthier farmers are more apt to be opinion leaders and are more likely to have enough resources to risk innovation. Therefore it is logical for extension workers to introduce the innovations with these influential individuals and to anticipate that the innovations will spontaneously diffuse outward from these leaders.

Since a normal market economy favors those who are wealthy enough to invest resources in innovation, it can be argued that the benefits of innovation will always be distributed inequitably, regardless of whether the diffusion system is centralized or decentralized. However, in the more centralized system, control over the initial distribution of innovations rests in the hands of change agents.

In the most extreme form of horizontal diffusion, there are no change agents (as noted previously). Potential adopters select themselves and no one has the role of following-up the introduction of an innovation with technical information and help.

For instance, in Legitech, the legislators or their assistants decide what innovations they wish to try. On their own initiative, they seek further information and technical advice about the innovation. Theoretically, everyone in the system has equal access to the innovations being diffused.

Of course adopters in both centralized and decentralized systems need technical help in implementing an innovation, or even in making the initial decision, once they are aware of the innovation. In the centralized model, the adopter can reach back through the system to whatever level of technical expertise s/he needs -- back to the scientists in national R&D labs, if need be. However, this process of seeking information and help proceeds through specified channels: farmer to county extension workers to state extension specialists to scientists in R&D laboratories. It is rare that the ultimate adopter of an innovation in the centralized system meets face-to-face with the originator of that innovation.

In contrast, face-to-face contacts between adopter and innovation source are a distinguishing feature of a horizontal diffusion system. In

Legitech, for example, an adopter can contact directly the other legislator or resource who has solved the problem of how to set up a recycling program, or who has originated legislation encouraging energy conservation, or whatever. There are no formal, heirarchical channels to go through.

In many horizontal (or relatively horizontal) diffusion systems, face-to-face exchange between potential adopter and the innovation originator is formalized through site visits. That is, the potential adopters travel to see the innovation in operation, in a context, so that they may address their questions directly to their peers who have actually struggled with the implementation problems they themselves will face if they decide to adopt the innovation.[8]

For instance, the U.S. Department of Justice National Institute of Law Enforcement and Criminal Justice (NILECJ), which is part of the Law Enforcement Assistance Administration (LEAA), funds senior criminal justice officials (such as a city police department chief) to visit one of 14 innovations which have been selected by an NILECJ committee as models.[9] For example, the Street Crime Unit of the New York City Police Department has developed techniques utilizing decoys in high crime areas, and this unit is a frequent site for visitors.

Another example comes from China. For several decades, the Peoples' Republic of China diffused innovations by praising some locally developed program as a "model" for the nation to follow. The Tachai Production

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[8] A similar process occurs when farmers travel to neighboring farms to see a demonstration plot. The difference is that while the owner of the plot is the first adopter of the innovation, s/he is rarely its originator.

[9] The fact that the innovations are selected for diffusion and hence legitimized by this committee makes this diffusion system somewhat less horizontal than Legitech. However, the innovation is still being transferred laterally, between peers.

Brigade in Sensi Province, an area of rocky soil, erosion and poor agriculture, became famous because of the sensational triumph over nature made by the 90 brigade households. Without outside help, they built terraces and underground conduits to fight annual flooding, adopted chemical fertilizers and other new agricultural techniques and thereby raised their grain yields from 1,050 kilograms per cultivated hectare in 1949 to 5,295 in 1965-66 and to 8,220 in 1971 (Perkins and others, 1977). The slogan, "In agriculture, learn from Tachai" was ubiquitous in China for the past decades, with the result that Tachai was flooded anew -- this time with visitors. In 1977, the tiny area received an average of over one thousand visitors a day, who came to learn how to grow grain and to develop self-reliance.[10]

The United States has its own "Tachai" in the form of Davis, California, which has been promoted by the Federal government (especially following Rosalyn Carter's visit in 1978) and by the mass media as a model of community-level energy conservation. The City of Davis' Community Development Department is inundated daily by telephone and mail requests for information about their use of energy conserving innovations and by visitors who come in person to see the compact police cars, the community gardens, the passive and active solar-heated homes, the bicycle lanes, and the energy conserving building codes.

Davis is an example of unintentional horizontal diffusion. Davis' city planners originated the energy conserving innovations out of concern

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[10] During 1980, the grain yields of the Tachai Brigade were questioned officially by the Peking government, who claimed that they had been falsified. Since the demise of the "Gang of Four," the famous Tachai leader, Chen Yong-Gui, who was associated with that regime, has dropped from public view. The slogan has also become much less prominent in the past two years.

for their own future, never expecting that they would be called upon to diffuse these innovations to countless other community planners and citizen groups. No change agents were assigned to aid in the diffusion process; no government agency deliberately set up site visits or funded people to travel to Davis. Yet the media broadcasts the message "in energy conservation, learn from Davis," and the visitors continue to pour in.

This example of an informal horizontal diffusion process, like its more structured counterparts, has suffered from the lack of a mechanism to transfer expertise about the innovations. Overloaded by requests and underfunded for response, Davis city officials have served as unpaid change agents, explaining to visitors and even taking their show on the road with slides and talks. Their reward, common to other innovators in a horizontal system such as legislators or legislative staff in Legitech, consists mainly of public recognition.

In some horizontal systems, a more formal reward accrues to innovators. For instance, a future version of Legitech will assign credit to those individuals or communication nodes (they can be organizations) which contribute to the system, and will deduct points when a user derives information from the system. Such a reward structure alleviates to some extent the "free rider" problem which tends to characterize horizontal systems, in that it penalizes those who would draw innovations out of the system and contribute none.[11]

However, even such a reward system does not solve the problem of quality control. In an almost pure horizontal system, such as Legitech,

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[11] "Free riders" are a problem only if the system participants object to them. Some Legitech members have complained, for instance that they are doing research for other state legislatures, thus expending valuable time and resources, for little return. A critical mass of innovation-providers is essential to such a system.

only experience in the system allows users to determine what the quality of an innovative suggestion is likely to be, judged according to its source. Other, less extremely horizontal systems solve this problem by setting up evaluative committees who review innovations which are slated to be diffused. These committees are often drawn from the population of users and therefore constitute a peer review group, but they are nevertheless a source of centralized control on the diffusion system. They also insure some kind of standard for innovation exchanges, so that participants in the system reap not only the quantity but quality of information they themselves contribute to the system.

A Hybrid Diffusion System

To clarify further the differing characteristics of horizontal and centralized diffusion systems, we now describe a system which is not as decentralized as Legitech but which is far more horizontal than the agricultural extension model. The National Diffusion Network (NDN) began in 1973 by a quirk of bureaucratic budget handling; officials in the U.S. Office of Education were faced with the problem of "year-end money," dollars which had to be spent by the end of the fiscal year. They decided to allocate the funds to local schools who had developed an innovation, for use in spreading these new ideas to other local schools. The local sources of educational innovations were called "developer/demonstrators." About 150 such developer/demonstrators were funded, each to horizontally diffuse an innovation that had been approved as a "validated practice" by a committee of Federal experts. The modest Federal funds were used by developer/demonstrators to publish brochures and other mass media messages, to provide training for potential adopters, and to demonstrate the local innovation to other school teachers. Few of the initial 150 innovations

were "standard" innovations like those that had been promoted previously in a decade of center-periphery diffusion by the U.S. Office of Eduction: Team teaching, programmed instruction, teacher aides, etc. All public schools were expected to adopt those new ideas, which mainly had been invented by research and development laboratories. But the NDN innovations diffusing from the local developer/demonstrators were appropriate only to certain schools with particular problems. And even then, many of the developer/demonstrators' innovations were re-invented by other schools when they implemented them under their local conditions. Further, some of the innovations were re-labeled with a local name by certain adopters, even when an innovation's form had not really been modified very much or not at all. The psychological effect of such renaming was to give the innovation a local identity and to encourage pride of local ownership.

How successful is the National Diffusion Network? At the end of its first three years of operation, the 150 innovations had been accepted by several thousand adopters (Emrick and others, 1977). The NDN was generally very popular with school personnel and the public. This popularity was translated into political support by the U.S. Congress, who began to give the NDN a regular budget (with a major increase to $25 million in 1977). A precise measure of NDN's impact was difficult to obtain because so many different innovations were spontaneously flowing out from the developer/demonstrators, and each of these innovations took such a variety of forms. The result certainly seemed to be innovation in U.S. education, but it was not a result that could be conveniently measured.[12]

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[12] At least as conveniently and neatly measured as in the case of a center-pheriphery diffusion approach, where the usuaal measure of impact is the rate of adoption of innovations promoted by a Federal agency to local government units or to the public.

The NDN, Davis, and Legitech are all characterized by a sense of local control and ownership, both (1) of the innovations being diffused, and (2) of the system by which they are disseminated. Innovation scholars have been aware for some years of the influence of participation on the acceptance of innivations (Fairweather and others, 1974; Havelock and Havelock, 1973), and conscious of the so-called "Not Invented Here Syndrome," which is often blamed for organizational and individual resistance to new ideas. Horizontal diffusion systems may provide a means for alleviating the NIH syndrome by allowing considerable adaptation, or re-invention of the innovation which is diffused. Fewer built-in assumptions about the inviolability of the original innovation are usually found in the horizontal systems. Whether or not these decentralizied systems actually encourage re-invention is an empirical question.

Issues in the Study of Decentralized vs. Centralized Systems

Even this first, rather superficial examination of contrasting diffusion systems raises issues which are clearly central to the question: when are vertical or horizontal strategies preferable? Future empirical examinations of relatively centralized or decentralized systems (or of the centralized and decentralized elements within a given system) will need to consider at least the following:

- The relative ability of the system to bring relevant technical expertise to bear during the implementation of an innovation by an adopter.
- The degree to which the system is problem-centered versus solution-centered (technology pull versus technology push).
- The degree to which innovations undergo change ("re-invention") during diffusion.
- The degree and nature of quality control on innovation-related information passed through the system.

- The scope of the innovations (incremental versus radical) commonly diffused in the system. (Perhaps horizontal systems are more likely to diffuse incremental innovations).
- The presence and role of gatekeepers in the system -- are they facilitators or change agents?
- The relative predominance of varying information channels (interpersonal; media, etc.) in the system.

We expect that relatively horizontal and relatively vertical systems or system components will differ along the dimensions suggested in these issues. The challenge is to operationalize the concepts involved (e.g. degree of re-invention; the radicalness of the innovations) so that these issues can be developed into hypotheses to test empirically.

Summary and Implications

In this paper, we have presented a model of diffusion which differs from the classical "center-periphery" paradigm on several key dimensions. In this alternative method of diffusion, innovation users are not only the originators but often also the disseminators of the innovation. Dissemination of the innovation occurs through peer networks, utilizing such mechanisms as site visits or computerized inquiry-and-response dialogues.

We may hypothesize some possible advantages of such systems (from the users' point of view) namely: a sense of local ownership, hence user support for the innovations; greater variety in the innovations diffused through the system, lower rates of discontinuance, and greater "re-invention" of the innovations. (Obviously, this last characteristic would not necessarily be an advantage from the originator's vantage point).

We also expect to consistently find certain disadvantages to such horizontal diffusion systems: the transfer of the technical know-how

necessary to implementation is not guaranteed in the system; neither is there any built-in quality control. In extremely decentralized diffusion systems, no official "facilitator" or professional evaluator judges the innovations; hence, the buyer must beware. Finally, in extremely decentralized systems such as the Legitech example in our paper, there are few incentives for an innovation-rich "Scrooge" to share with innovation-needy peers besides an altruistic concern for the larger societal Good, or the chance to gain a certain amount of fame. Similarly, there are few built-in disincentives to the free rider, who consistently draws out innovation information from the system but who does not pay anything into the system.

We need to know much more about these possible advantages and disadvantages -- when the former accrue and consequently a horizontal or decentralized system is appropriate, and how the latter may be overcome. There are already experiments underway to counteract the Scrooge/free rider problem by crediting an information or innovation provider and by debiting those individuals or organizations who derive value from the system.

Several forces at work in society may serve to increase the number of cases in which horizontal systems for the diffusion of innovations are appropriate. First, the potential for decentralized information sources grows as computerized communications diffuse through society. Just as the invention of the telephone increased the scope or reach of every individual's verbal communication, so computers are multiplying the capacity for individual information sources to transmit written information. Second, problems of information overload will lead to increased personalization in information origination and receipt. One communications flow census showed that whereas the production of words in

all media combined is growing at about 10 percent per annum, consumption of words is increasing by only three percent annually. Therefore, the average number of audience members for each word must be decreasing (de Sola Pool, 1980). One response to such information overload is more careful screening of the information used — more sorting before consumption. The plethora of specialized magazines in the U.S. catering to ever more carefully targeted audiences evidences a form of increasing specialization in information flow, for example.

Therefore, it seems highly likely that our needs for pre-screening of information are going to increase, not decrease. If past experience is any guide, we will continue to prefer interpersonal sources of information, especially peers who have already sorted through the alternatives. They have already fit available information to their needs, which are very similar to our own. This increasing need for help in selecting relevant information, together with the ever more accessible and sophisticated technological means for contacting peers across geographic distances, may account in part for the popularity of the concept and term, "networking." Horizontal diffusion can be viewed as the formalized use of peer networks to disseminate innovations.

If, as we believe, the use of such systems is increasing, it behooves planners and social science researchers alike to understand the dynamics of such systems and to define those conditions under which they function best.

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